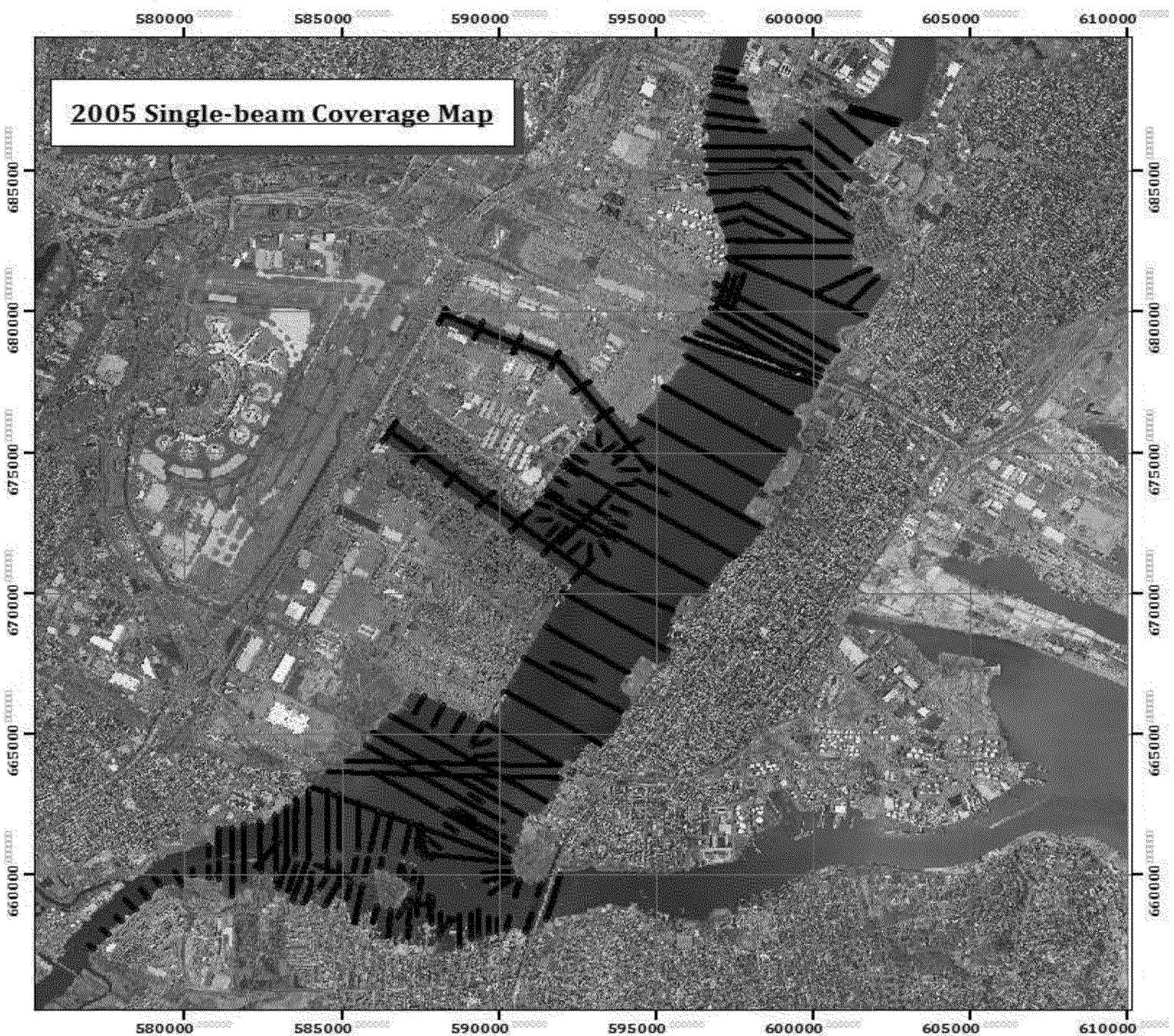
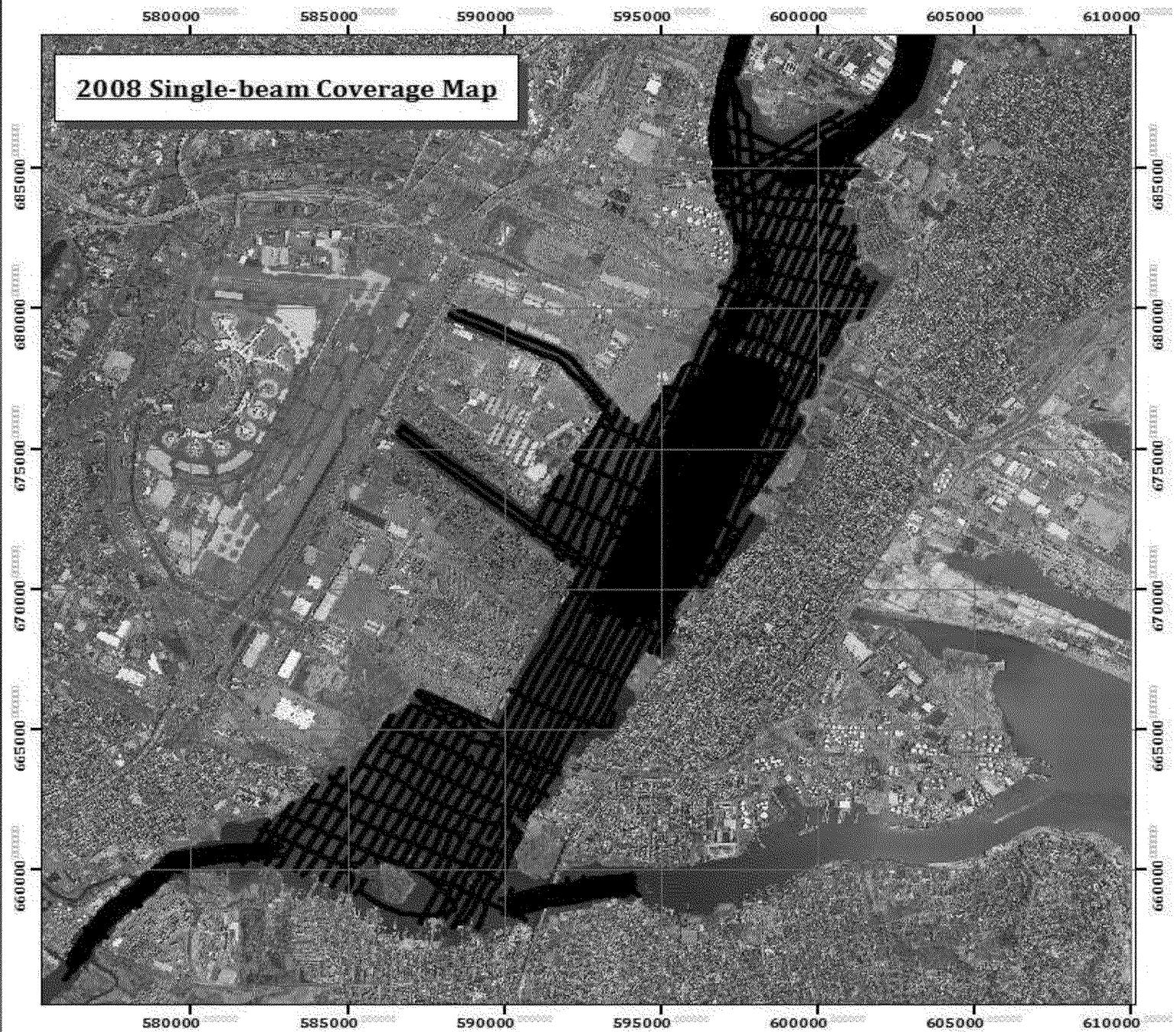


2005 Single-beam Survey Coverage



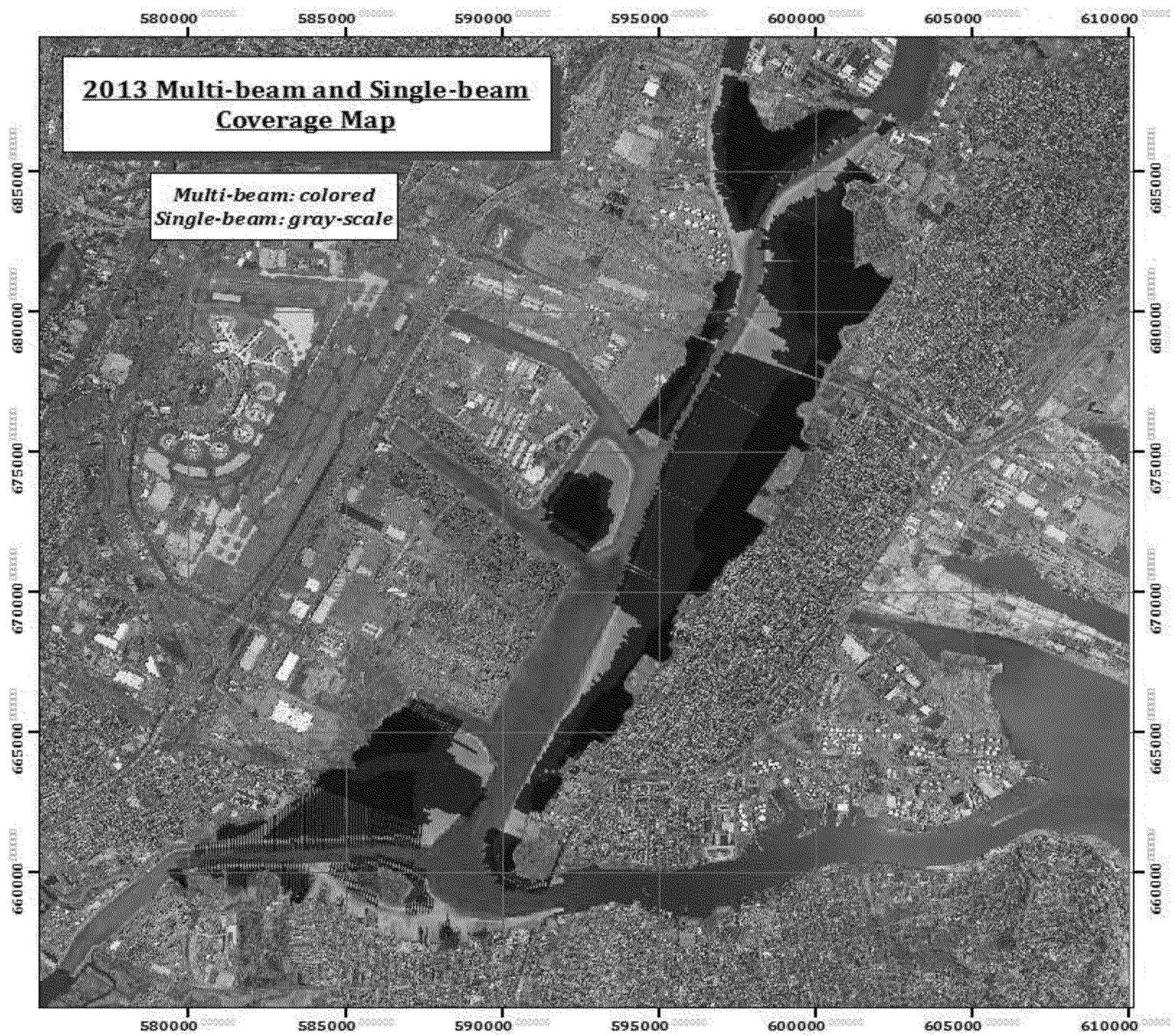
2008 Single-beam Survey Coverage



2013 Single-beam and Multi-beam Survey Coverage

Why is this
important?

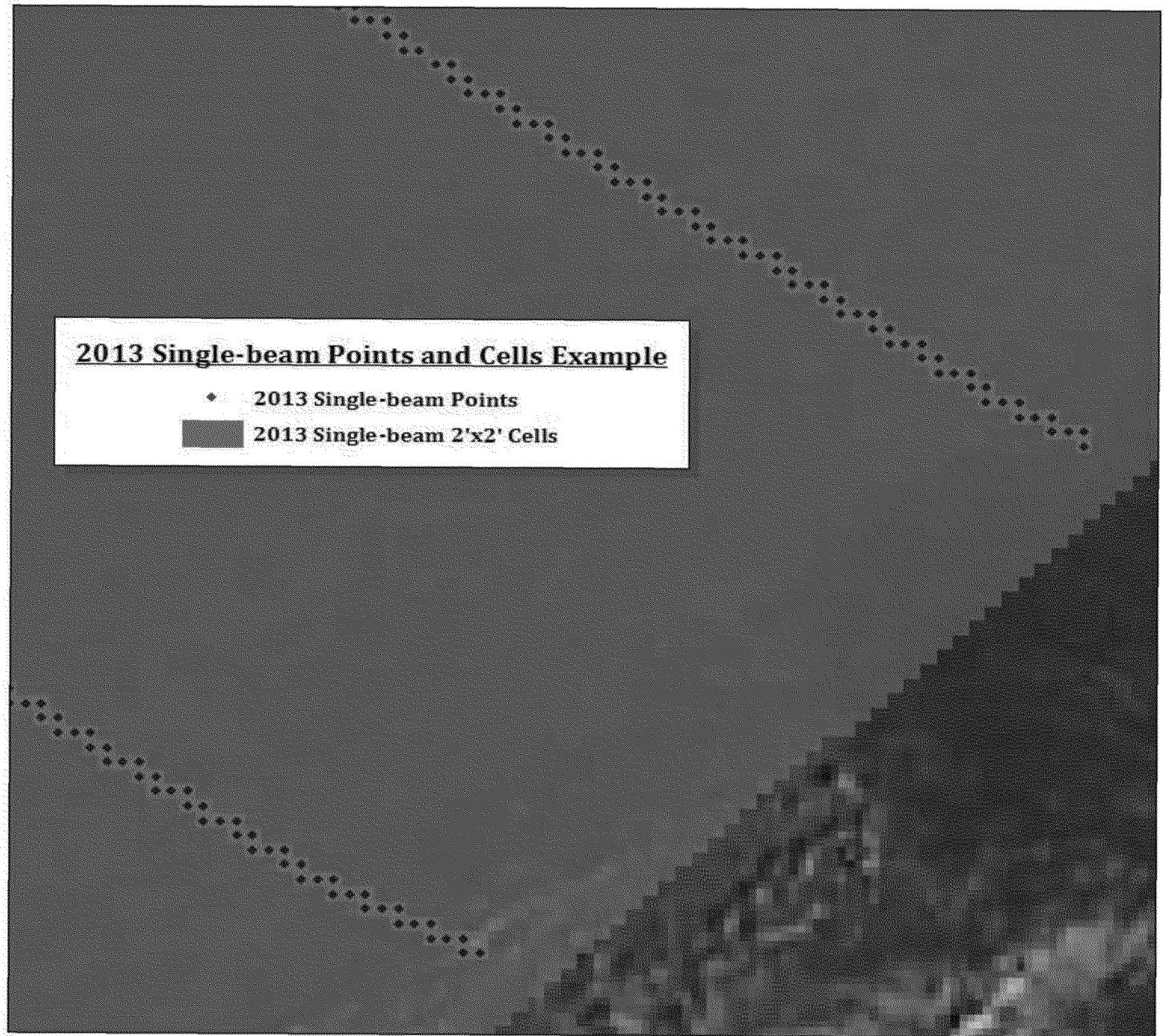
- 1) Interpolation
- 2) SB / MB
Uncertainties



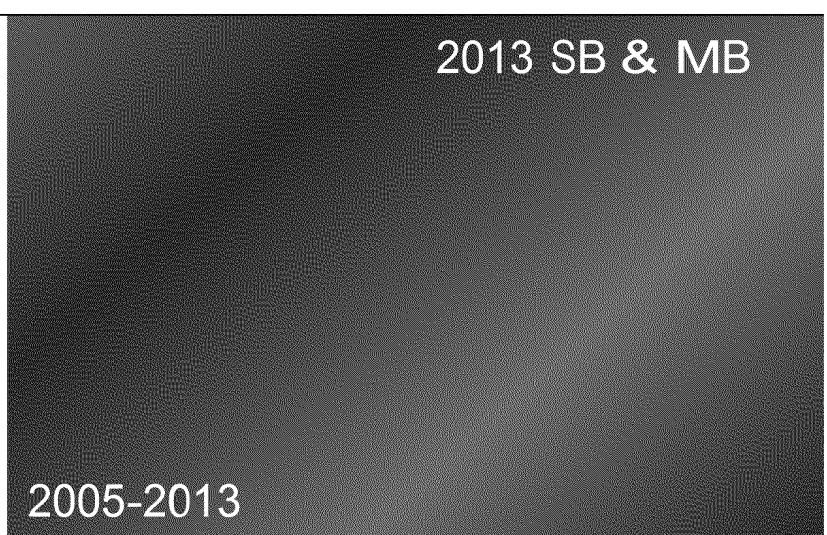
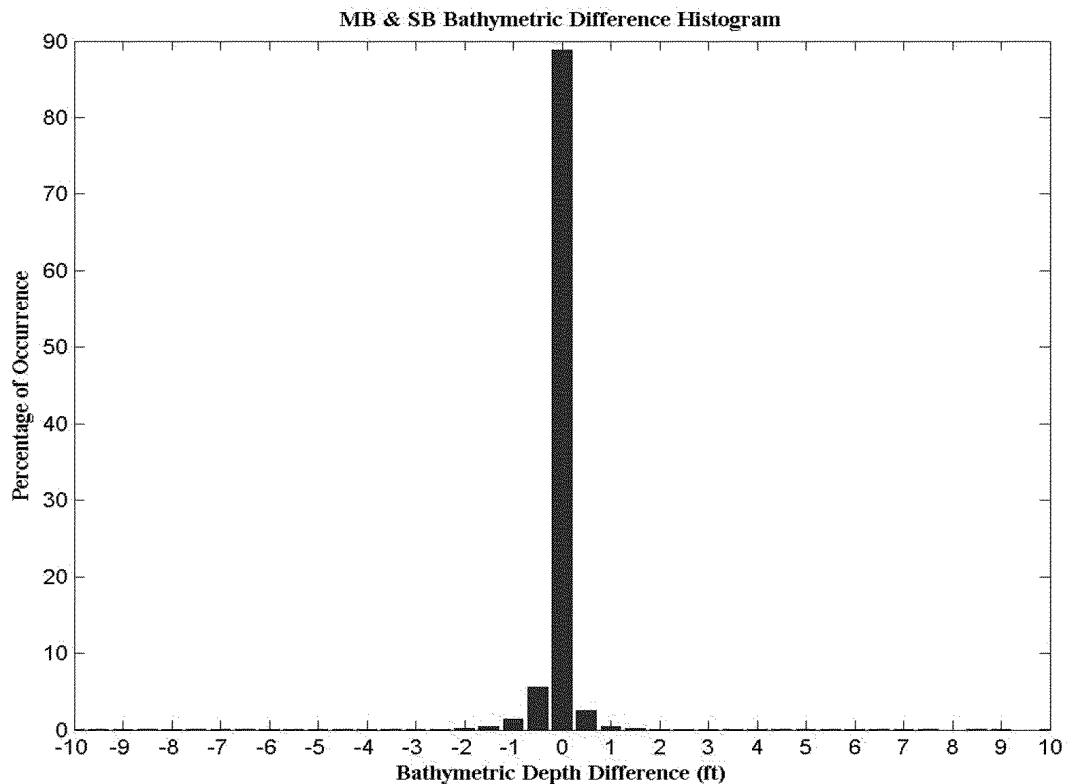
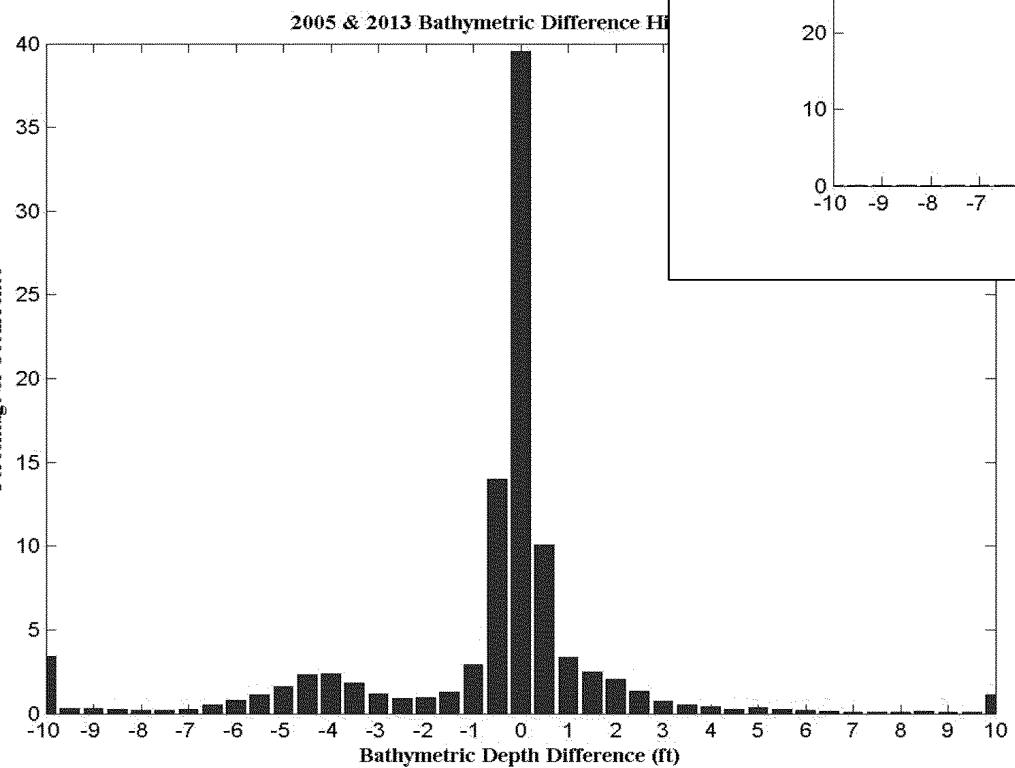
Verification of Proper Vertical Datum

3 Comparisons:

- 1) 2013 SB & MB
- 2) 2005 SB to 2013 DEM
- 3) 2008 SB to 2013 DEM



Bathymetric Histograms to Validate



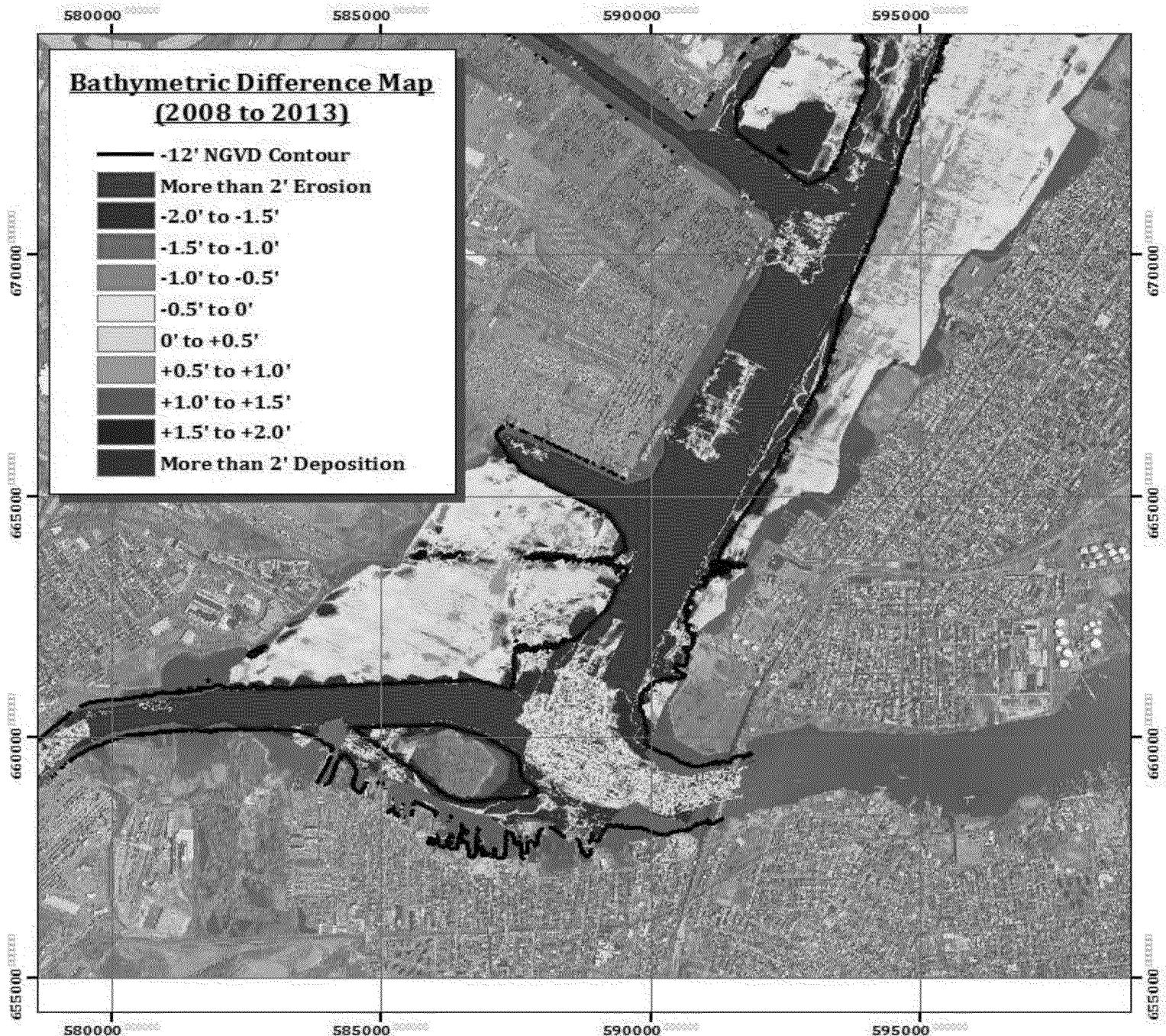
NBSA-wide Comparison

Difficult to quantify annual change rates over entire region

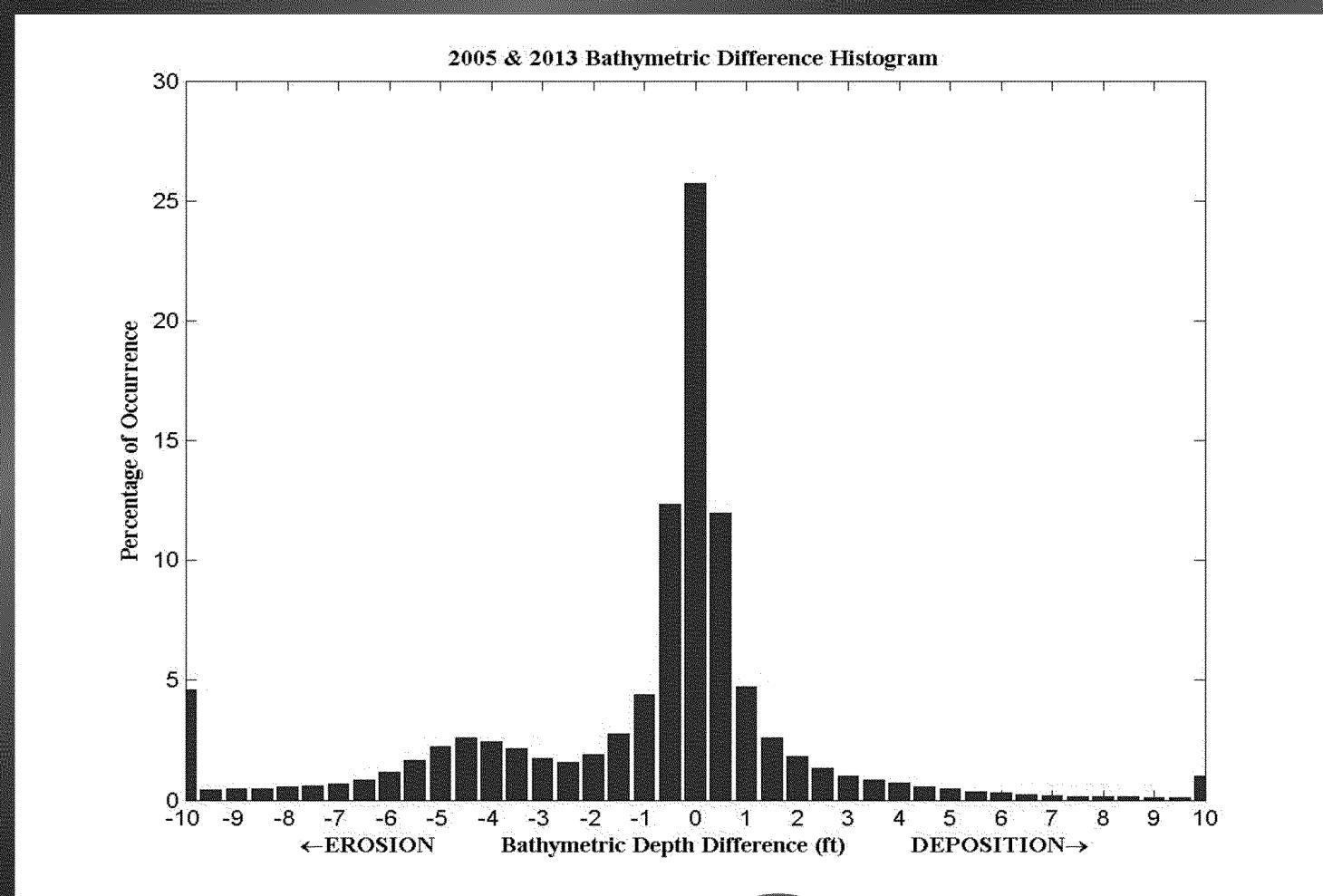
Three Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2008-2013
South



NBSA-wide
Comparison -
Histograms



Comparison	Mean	Median
1) 2005-2008	-0.79'	-0.19'
2) 2008-2013	-0.72'	0.09'
3) 2005-2013	-1.29'	-0.17'

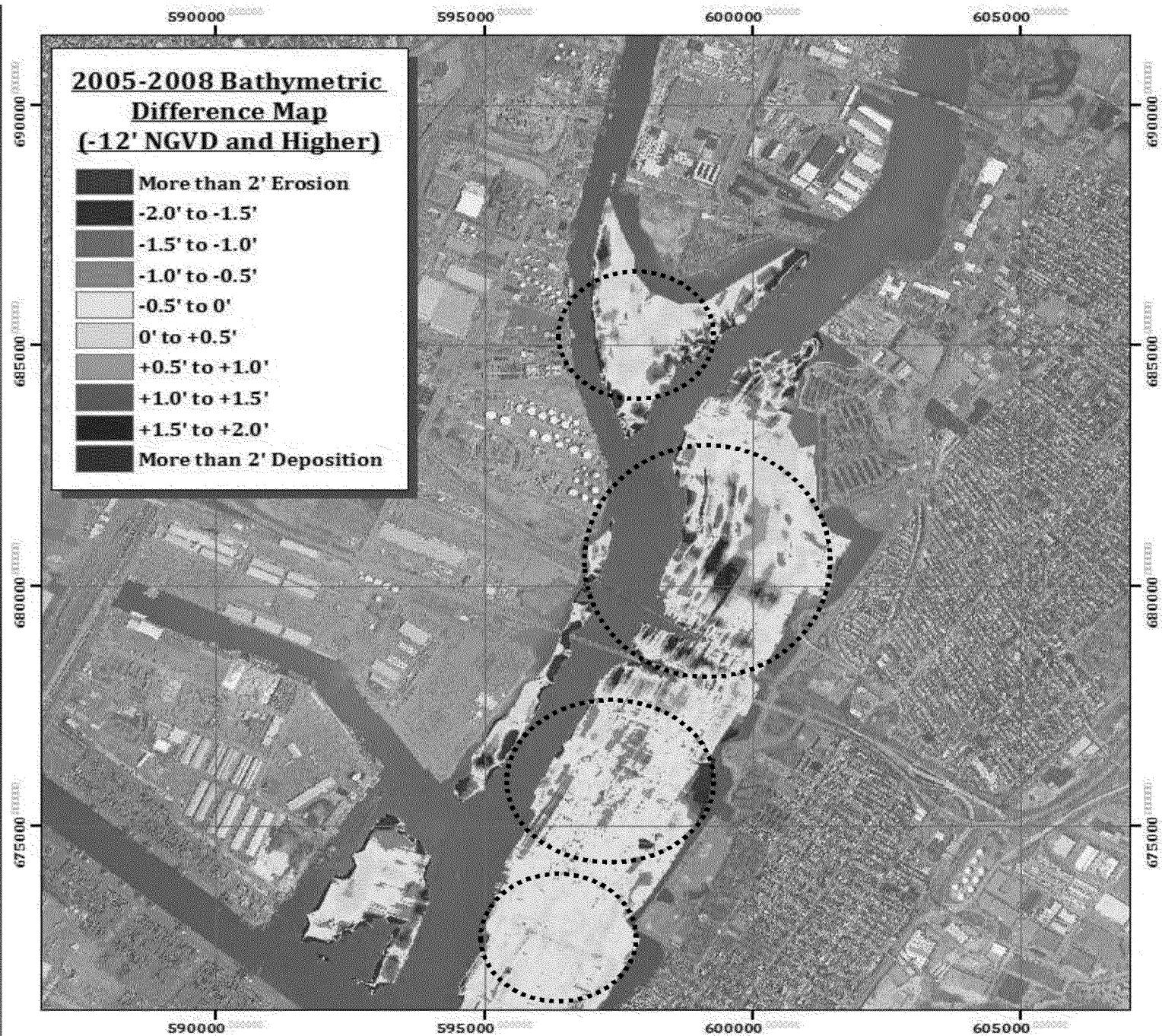
Subtidal Flats Comparison

Considering only
-12' NGVD
elevations and
higher

Same Three Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2005-2008
North



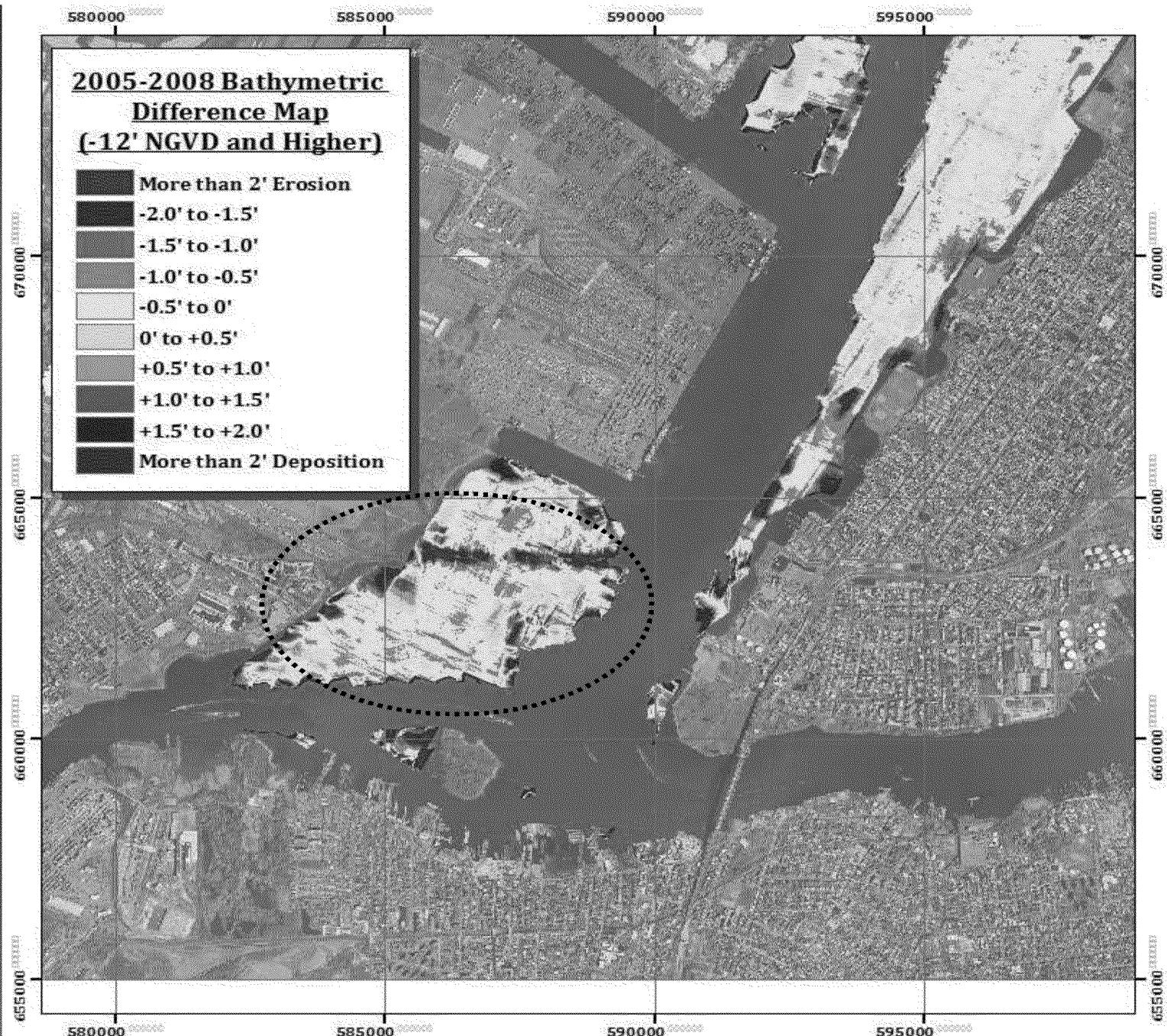
Subtidal Flats Comparison

Considering only
-12' NGVD
elevations and
higher

Same Three Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2005-2008
South



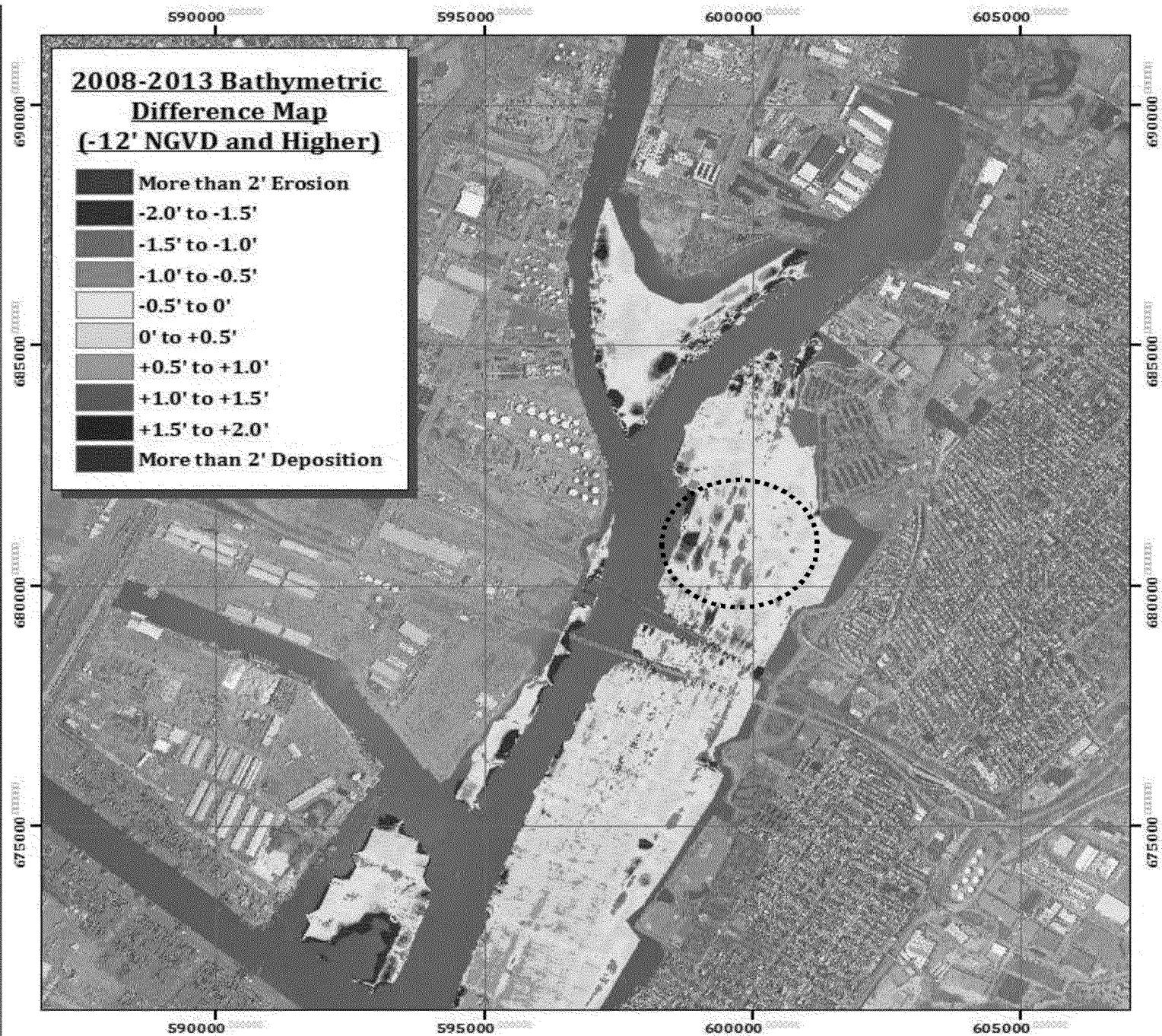
Subtidal Flats Comparison

Considering only
-12' NGVD
elevations and
higher

Same Three
Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2008-2013
North



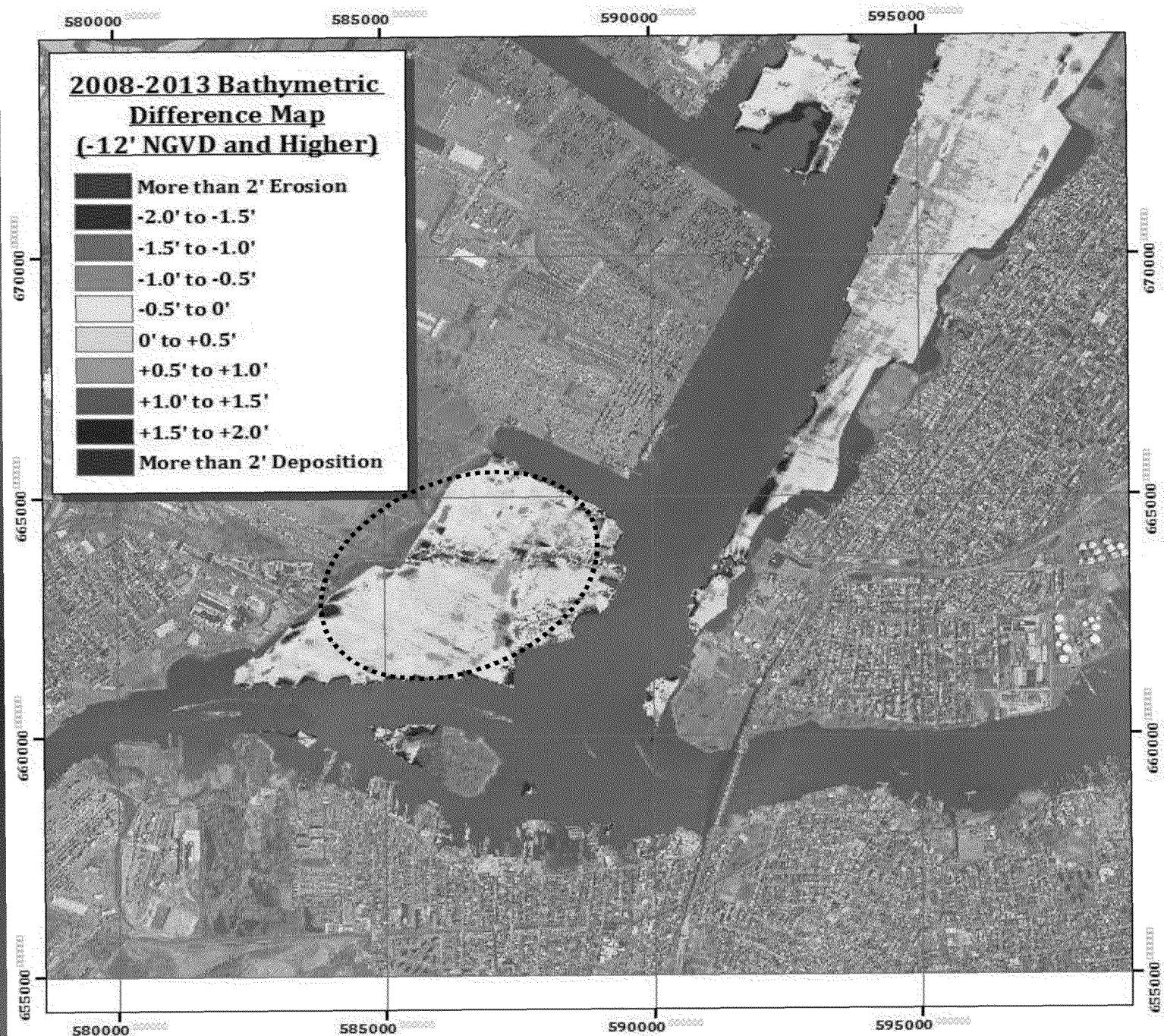
Subtidal Flats Comparison

Considering only
-12' NGVD
elevations and
higher

Same Three Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2008-2013
South



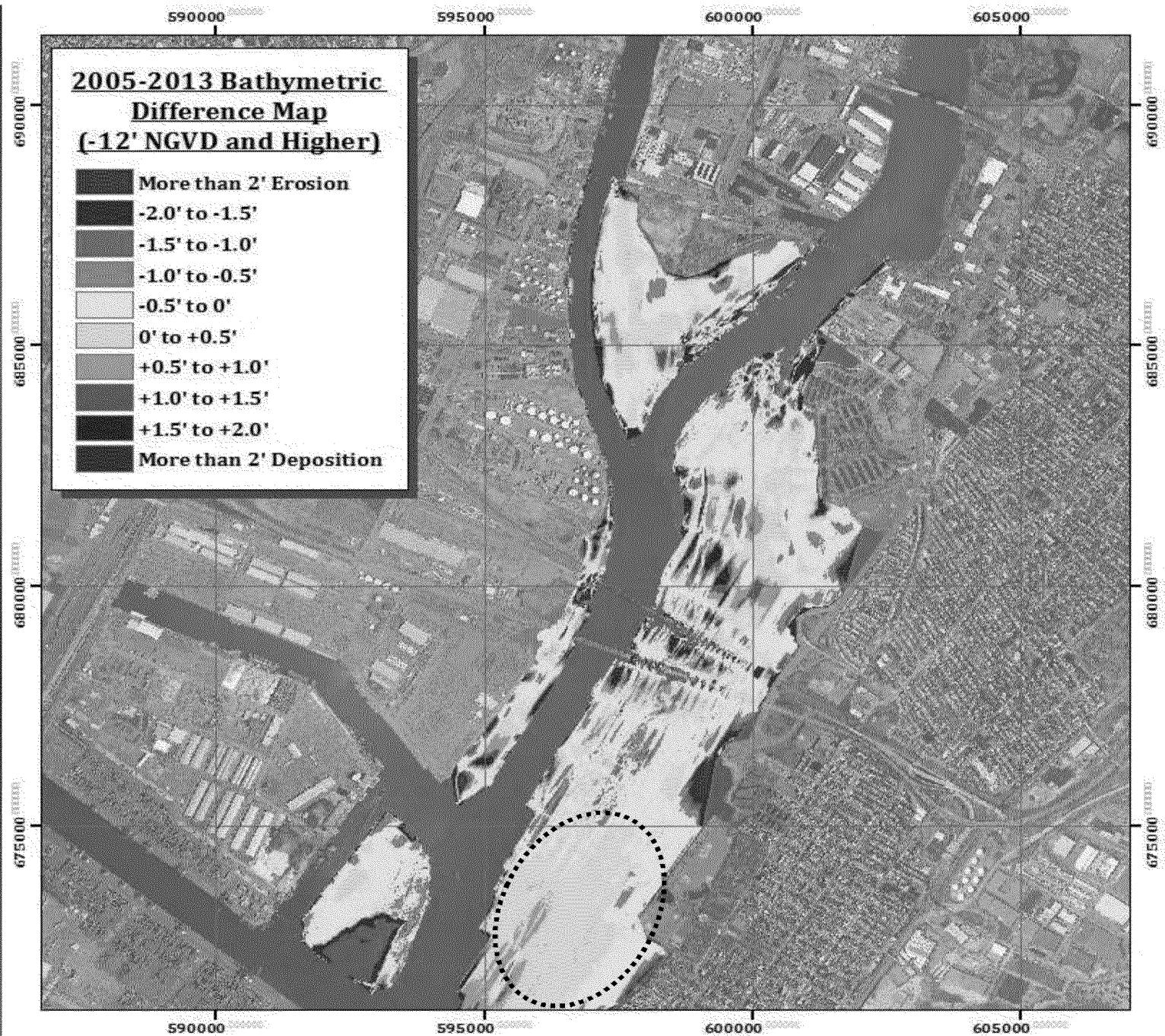
Subtidal Flats Comparison

Considering only
-12' NGVD
elevations and
higher

Same Three
Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2005-2013
North



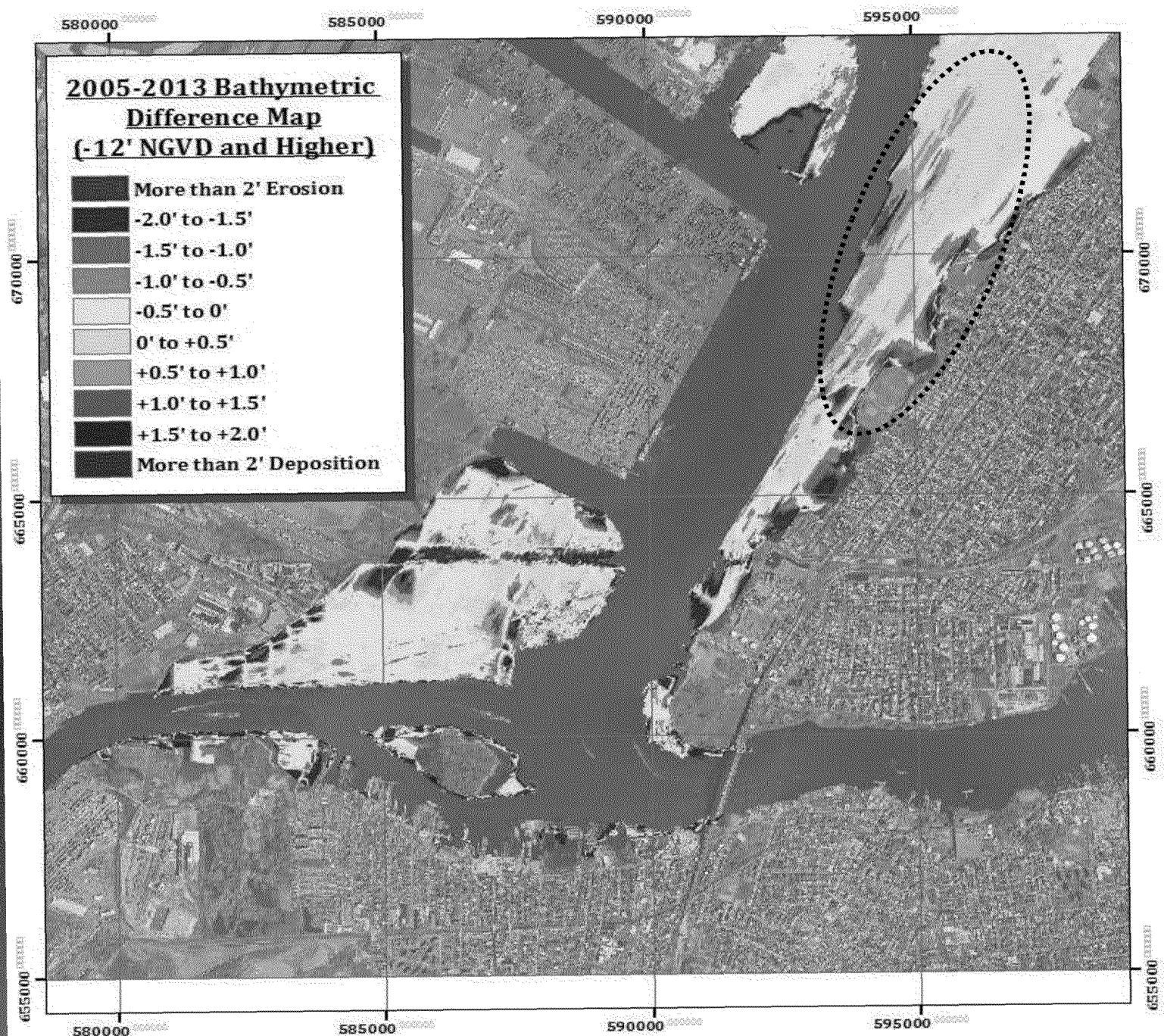
Subtidal Flats Comparison

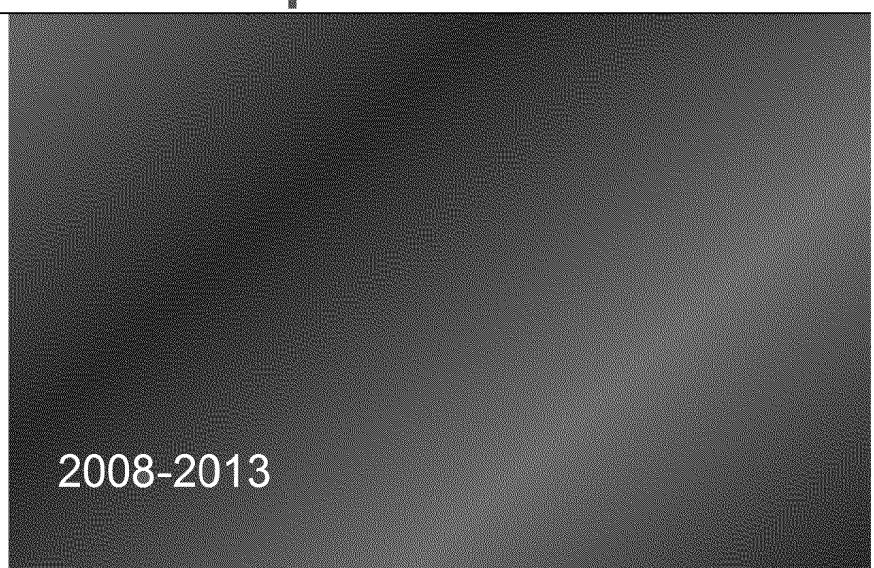
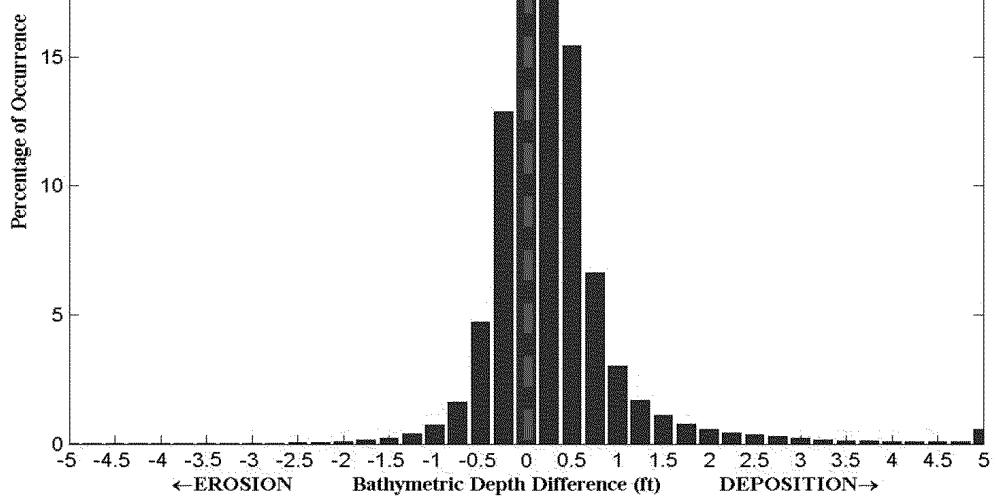
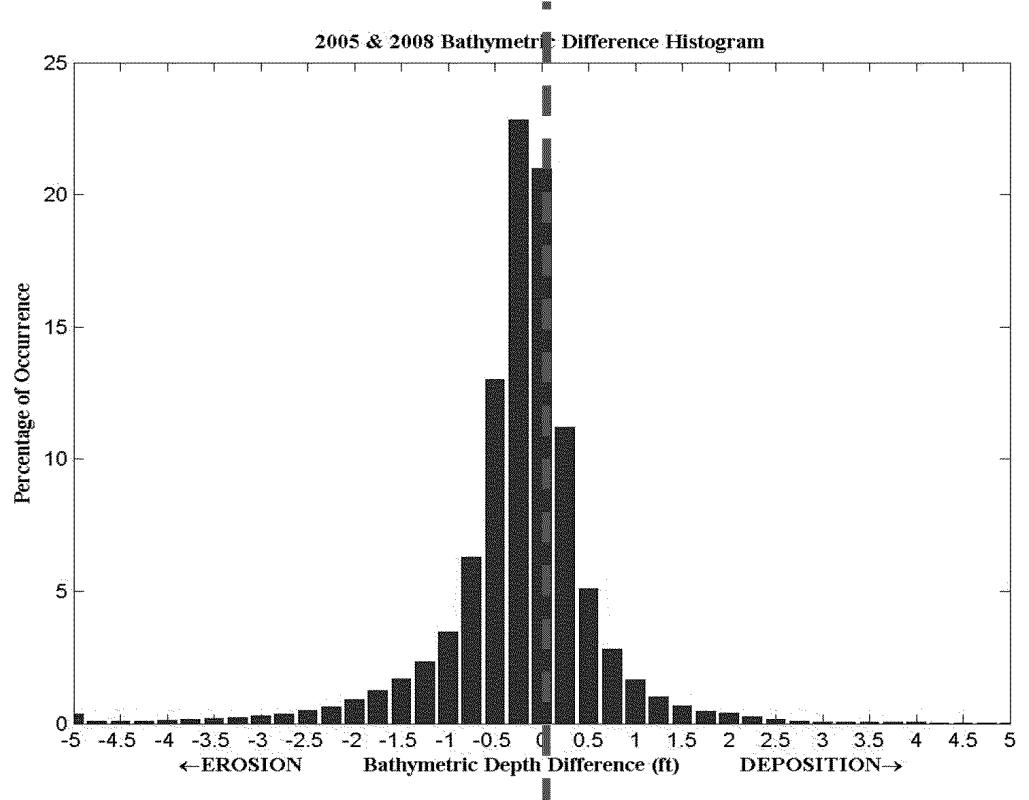
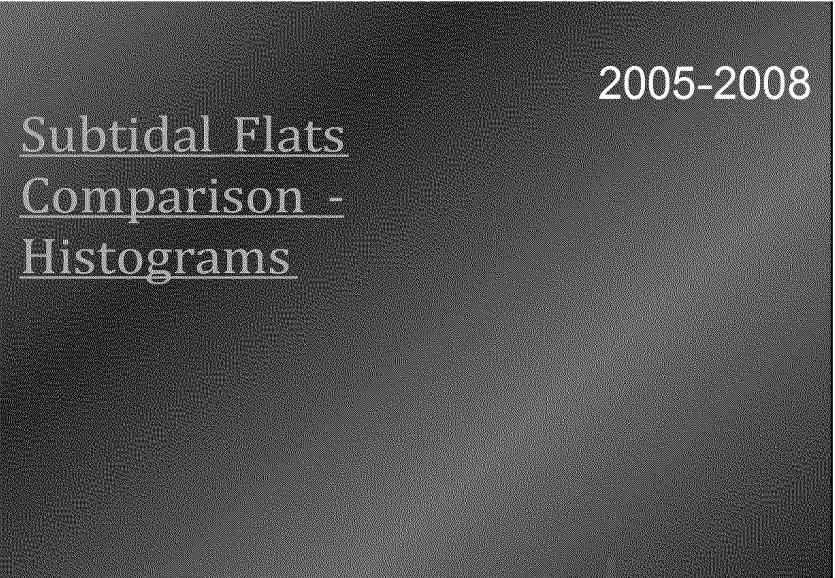
Considering only
-12' NGVD
elevations and
higher

Same Three Comparisons:

- 1) 2005-2008
- 2) 2008-2013
- 3) 2005-2013

2005-2013
South





Subtidal Flats Comparison – Histograms Statistics (Values are in feet)

Percentage of difference values within each range

<u>Comparison</u>	<u>+/-0.25'</u>	<u>+/-0.5'</u>	<u>+/-1.0'</u>
2005-2008	55%	73%	87%
2008-2013	60%	80%	92%
2005-2013	58%	74%	87%

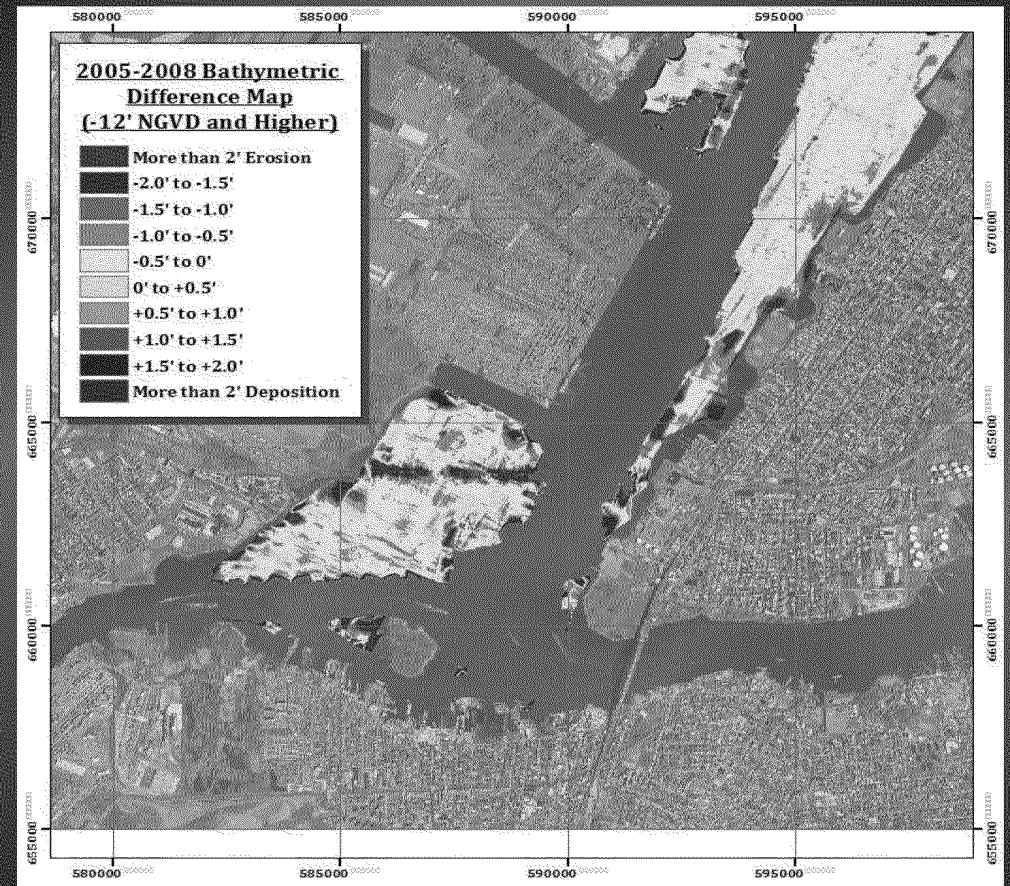
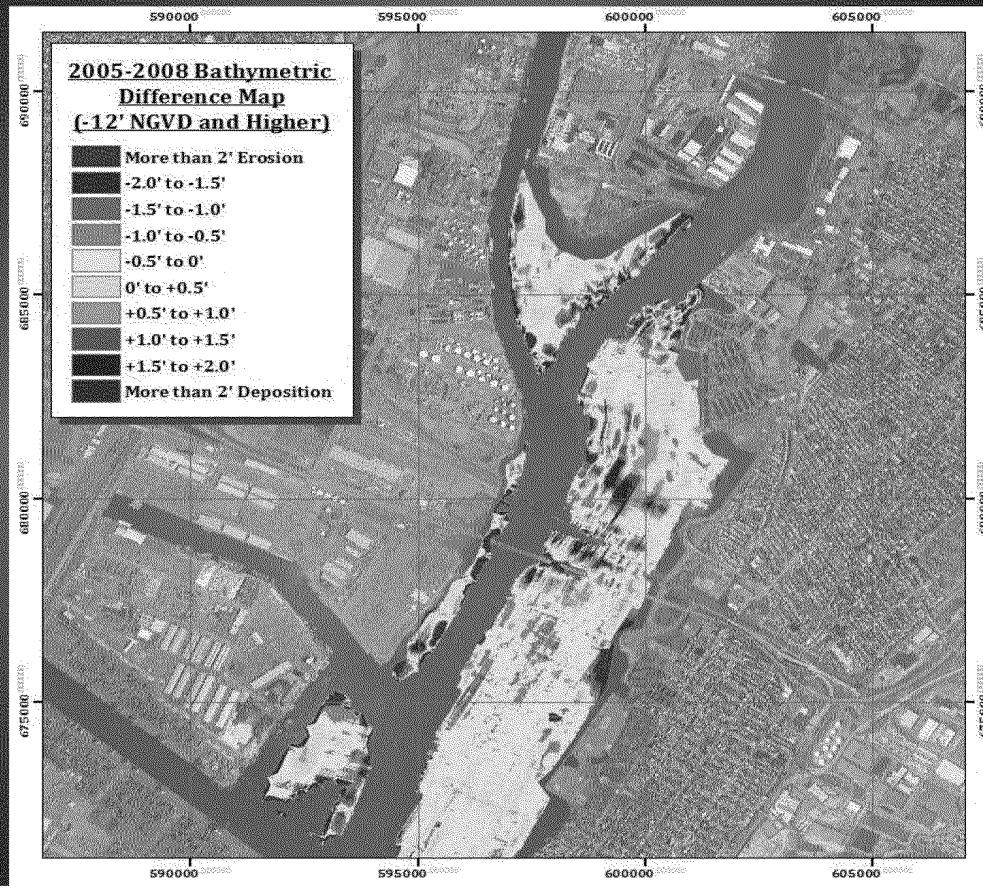
Histogram Statistics

<u>Statistic</u>	<u>2005-2008</u>	<u>2008-2013</u>	<u>2005-2013</u>
Mean	-0.25'	0.28'	0.027'
Median	-0.17'	0.18'	-0.02'
Standard Deviation	0.88'	0.79'	0.95'
Minimum	-9.73'	-7.71'	-9.23'
Maximum	9.07'	14.09'	13.32'

Conclusions

Between 2005 and 2008 (slightly erosional):

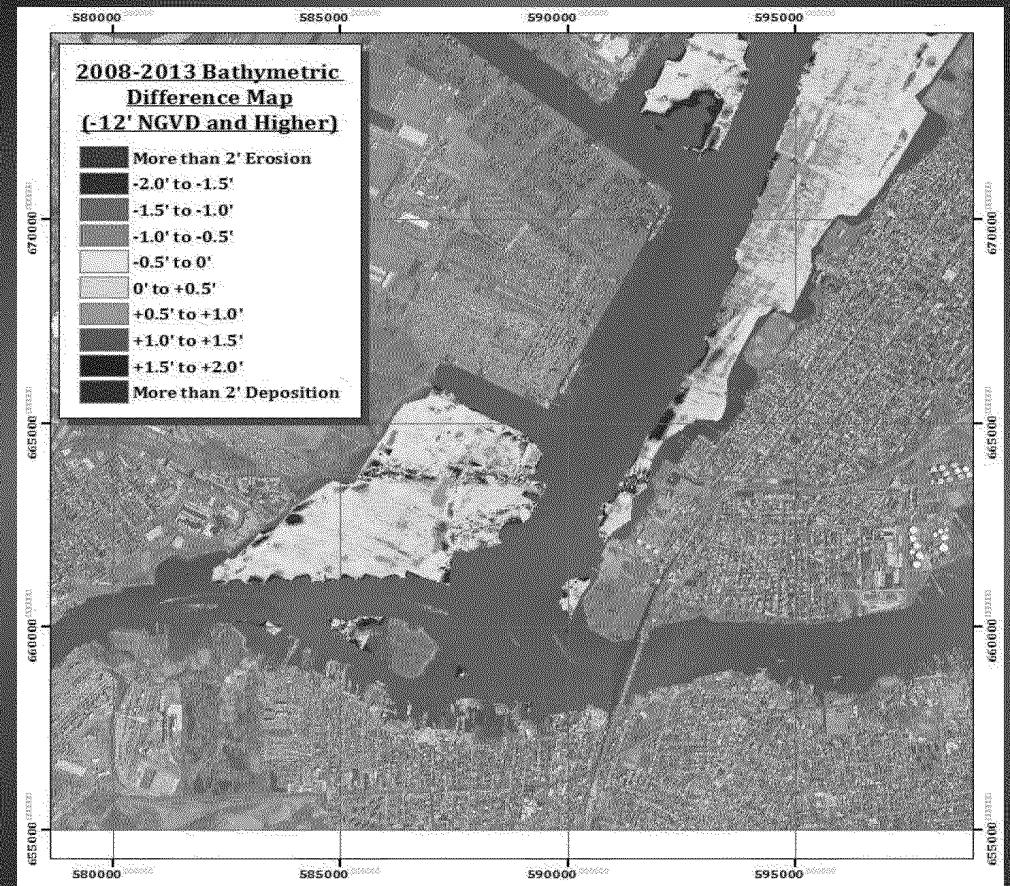
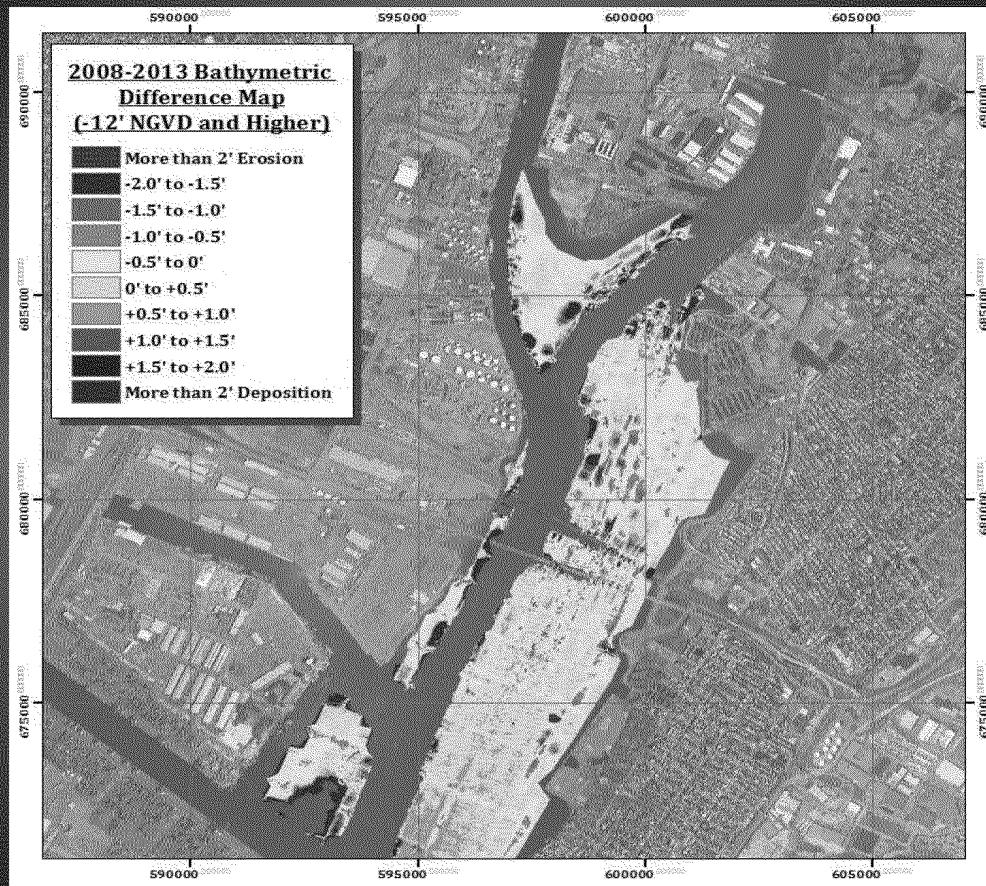
- **NE Subtidal** Flat near the Hackensack River comprised mixed erosion/deposition trends and some large magnitude erosional locations.
- **NE Subtidal** Flat area immediately north of the I-78 Bridge was depositional
- **E Subtidal** Flat immediately south of the I-78 Bridge was erosional
- **SW Subtidal** Flat was erosional



Conclusions

Between 2008 and 2013 (slightly depositional):

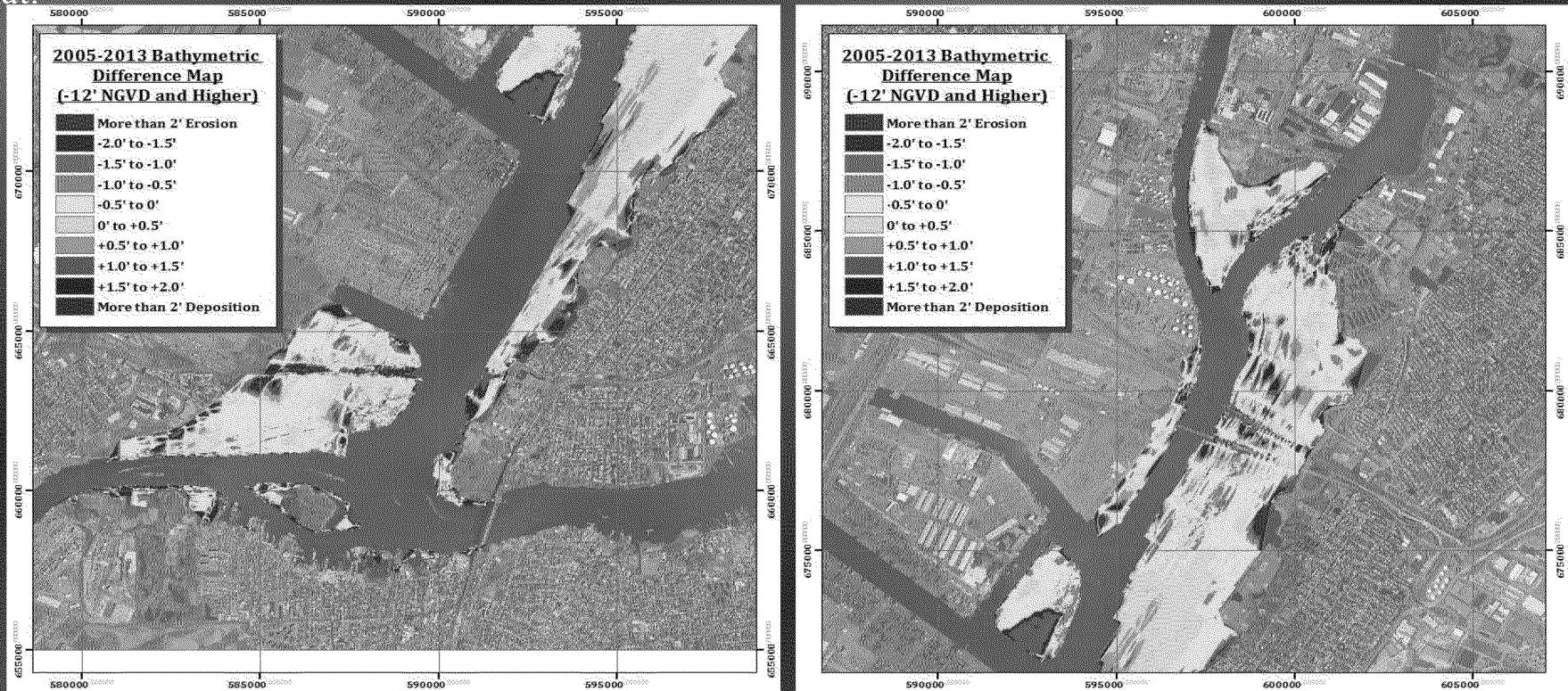
- **NE Subtidal** Flat near the Hackensack River was largely depositional
- **NE Subtidal** Flat area immediately north of the I-78 Bridge was slightly erosional with some depositional areas near the navigation channel
- **E Subtidal** Flat immediately south of the I-78 Bridge was depositional
- **SW Subtidal** Flat was depositional



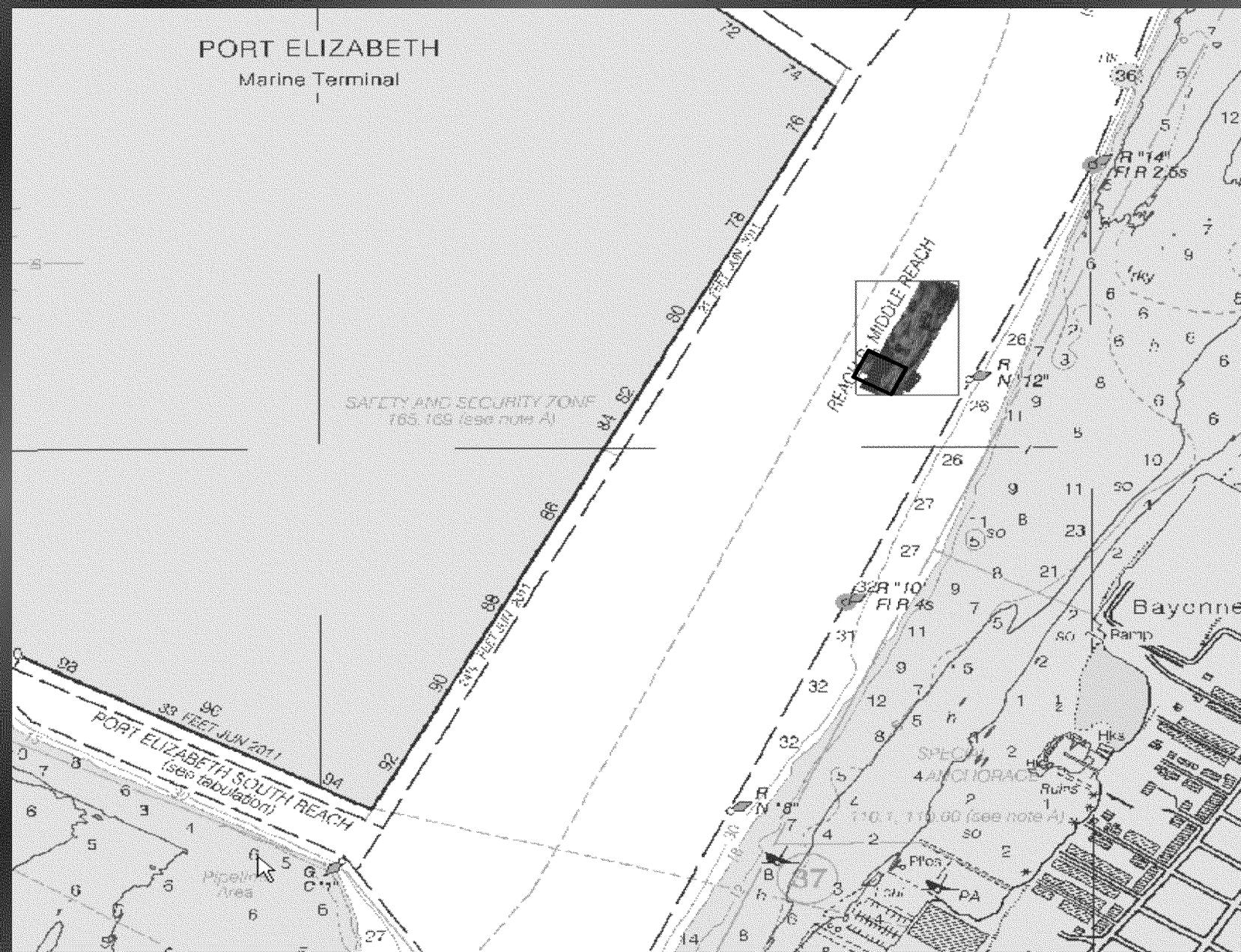
Conclusions

Between 2005 and 2013 (net change):

- Kearny Flats was subjected to erosion and deposition periodically as there was no clear erosion/deposition trend from survey to survey.
- NE Subtidal Flats near the Hackensack River experienced uncertain net change.
- NE Subtidal Flats immediately north of the I-78 Bridge was depositional (up to 2.0' or more deposited overall).
- E Subtidal Flats immediately south of the I-78 Bridge was erosional, overall.
- The remaining section of the E Subtidal Flats was depositional (up to 2.0' or more between 2005 and 2013).
- SW Subtidal Flat was, overall, of mixed erosion and deposition trends, in distinct regions of the mudflat.



Performance Testing Indicating Dynamic Sediment Environment?



Performance Testing Indicating Dynamic Sediment Environment?

- Multi-beam Reference surfaces in deep water and shallow water used on a nearly daily basis for both the single-beam and multi-beam boat
 - USACE criteria: +/- 0.2' mean bias & +/- 1.0' maximum outlier
- First 'reference' surface collected Dec 6, 2012
- Daily 'check' surfaces through Dec 21, 2012.
- First poor performance test results Jan 4, 2013.
- Daily 'check' surfaces continued subsequently
- New reference surface Jan 10, 2013
 - Jan 4, 2013- Jan 10, 2013 check surfaces passed USACE criteria
- New reference surfaces needed periodically as performance tests results deteriorated with time

So what does this tell us?

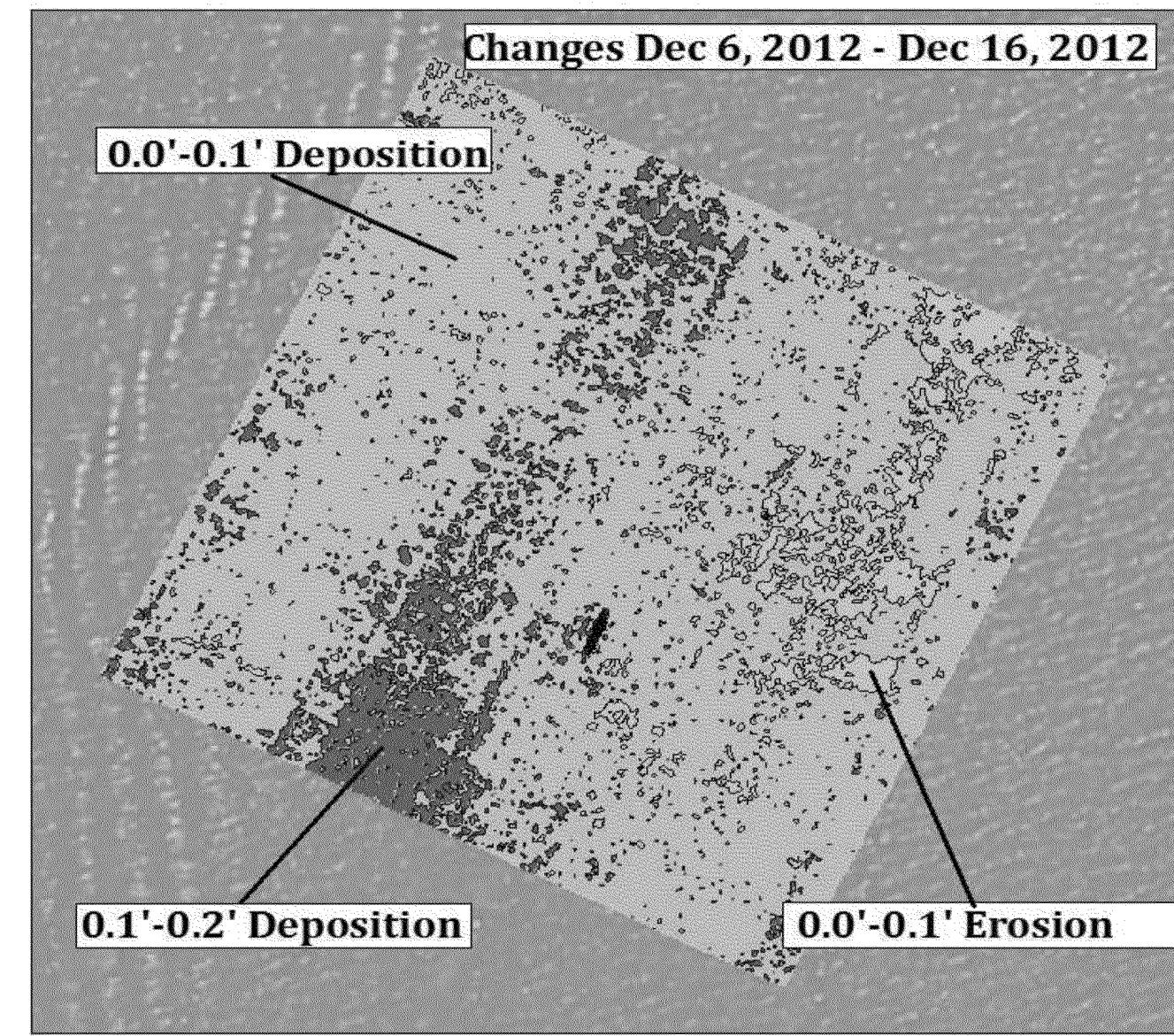
Performance Testing Indicating Dynamic Sediment Environment?

- Multi-beam sonar and ancillary equipment seems to be working sufficiently
 - RTK GPS
 - SVP
 - Bar Checks
 - Tides
 - Shallow Performance Tests – No concerns
 - Both SB and MB vessels measuring similar dynamic change in bottom elevation (0.1-0.2' variations between 'check' and 'reference' surfaces)

Suggests: The navigation channel at the reference surface location is dynamic

- Additionally, USACE survey data suggests (via pers. communication) that the navigation channel is a dynamic environment (w.r.t. sediment levels)
 - This has not been verified by the EPA yet, however

Performance Testing Indicating Dynamic Sediment Environment?



Performance Testing Indicating Dynamic Sediment Environment?

